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3-2017

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Zapata, Mildred, "BEAN SEED STORED FOR 12 YEARS USING SILICA GEL AT COMMON REFRIGERATION TEMPERATURE SHOWED HIGH VIABILITY AND GERMINATION PERCENTAGE" (2017). *Publications from USDA-ARS / UNL Faculty*. 1777.

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BEAN SEED STORED FOR 12 YEARS USING SILICA GEL AT COMMON REFRIGERATION TEMPERATURE SHOWED HIGH VIABILITY AND GERMINATION PERCENTAGE

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INTRODUCTION

Bean seed storage requires specific control of temperature and humidity. Different research institutions have expensive equipment and controls to maintain and preserve germplasm viability. However, not all laboratory facilities have the recommended equipment to guarantee long term storage with no adverse effects on seed germination and vigor.

During my research dealing with bacterial pathogens on the common bean (*Phaseolus vulgaris* L.), tepary bean (*P.acutifolius* A.Gray), the scarlet runner bean (*P.coccineus* L.) and other grain legume species, it has been necessary to maintain small quantities of seeds originating from experiments conducted at the greenhouse located in the Mayagüez campus of the University of Puerto Rico.

Over these years, seeds harvested in the greenhouse have been stored in a laboratory refrigerator. Some bean seeds have been stored directly in paper bags or envelopes enclosed in a plastic bag and some others were stored in the same way but using silica gel packages. This paper describes an easy and low cost method of storing bean seed for at least 12 years while maintaining a high germination percentage.

MATERIAL AND METHODS

Fourteen different genotypes which included *P.vulgaris* and *P.acutifolius* were harvested under greenhouse conditions in June 24, 2004. Four envelopes (6 x 11cm) of each genotype were prepared depending on seeds available. For each genotype group a seven gram packet of silica gel was added and placed in a plastic sandwich bag. Each bag was sealed using an impulse sealer (model AIE 300 of American Int.NL Electric. All genotypes were placed in another plastic bag in which three silica packet were added, sealed and placed at 4C in a Raetone refrigerator (Model AIE 300). Seeds were stored for at least 12 years under the conditions described above and were used on November 3, 2016. Seeds were pre-germinated for three days under laboratory conditions using sterile petri dishes containing a wet kimwipe paper (EX-L, Kimberly-Clark, USA) and then planted using the soil mixture PRO-MIX® (BX) and watered by drip irrigation. Germination was recorded seven days after planting. All plants showed normal growth.

Another group of germplasm lines stored without silica gel packets, but following the same methods described above, was also evaluated.

RESULTS AND DISCUSSION

All genotypes evaluated in which silica gel was used were viable with a range in germination between 80-100%. Of 14 genotypes evaluated, nine had 100% germination, four had 90% or more, and one had 80% (**Table 1**). None of the genotypes that were stored in the refrigeration in envelopes and sealed in plastic bags without silica gel were viable. Other separate assays were conducted and have shown similar results. Low temperature and humidity are important factors in seed preservation. Under our conditions electrical outages are common especially during the hurricane season. Thus, storage temperatures were subjected to changes, indicating humidity as

the main factor to control to maintain high seed viability and germination percentages. Salcedo (2013) described for post-harvest management of bean seeds sealed storage rooms at 15C and 10% relative humidity or to reduce seed humidity using silica gel at 2:1 or 3:1 ratio in closed cabinets or desiccation jars for small volumes. NCGRP recommends -20C for long term and 4C and 20-30% relative humidity for medium-term storage (Dierig et al., 2014). The method presented here is more simple, easy, inexpensive, while it overcomes temperature variability due to loss of electrical power and it is recommended for medium-long term-storage of small quantities of seeds.

Table 1. Germination percentage of *P.vulgaris* and *P.acutifolius* seeds preserved with silica for 12 years under refrigeration at 4C.

Genotype ¹	No. Seed planted	No. Seeds Germinated 3 days ²	No. Seeds Germinated 10 days ²	Germination Percentage 10 days ²
Tepary 1*	10	6	10	100.0
Tepary 2*	10	4	9	90.0
Tepary 4*	7	0	7	100.0
ICTA Ostua	11	9	10	90.9
ICTA Santa Gertrudis	12	11	11	91.6
Pecho Amarillo	10	10	10	100.0
MUG 132	10	8	8	80.0
MAR 2	11	11	11	100.0
MAR 309	11	11	11	100.0
DOR 364	11	11	11	100.0
Porrillo Sintético	10	9	10	100.0
212	10	10	10	100.0
DOR Pinto	10	3	9	90.0
11B	4	3	4	100.0
Total	137	106	131	
Total Germination %		78%	96%	

¹Genotype * = refers to *P.acutifolius*, otherwise = *P. vulgaris*. ²Germination percentage was recorded at 3 days in petri dishes and 7 days after planting in the greenhouse.

REFERENCES

Dierig, D., Blackburn, H., Ellis, D., and Nesbitt, M. 2014. Storage Protocols for Seeds at the National Centre for Genetic Resources Preservation (NCGRP) page 114. In: Curating seeds and other genetic resources for ethnobiology. Chapter 8, ISBN: 978-1-84246-498-4.

Salcedo JM. 2013. Regeneration guidelines for Common Bean. Biodiversity International (SGRP), Regional Office for the Americas, Cali, Colombia.